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NOTES ON ASPECTS OF THE LIFE HISTORY AND BEHAVIOR OF *COLEOTECHNITES ERYNGIELLA* (GELECHIIDAE).

Additional key words: *Eryngium*, herbivory, tallgrass prairie, Illinois

The Gelechiidae is one of the largest families of microlepidoptera, with between 4,300–4,600 species estimated worldwide (Hodges 1998, Arnett 2000); 87 genera and 813 species have been recorded from the U.S. and Canada (Arnett 2000). This number may be an understatement as only 30% of the Nearctic species have been described (Hodges 1998). In North America, there are approximately 47–49 species of *Coleotechnites*, of which eight are considered pest species, mostly on coniferous trees and shrubs. These pest species damage plants by eating the foliage and mining through the leaves/needles (Arnett 2000, Mississippi Entomological Museum 2005). Although numerous studies have been done on the pest species in this genus, very few, if any, studies have examined *Coleotechnites eryngiella* (Bottimer, 1926).

It is important to note that members of the family Apiaceae have a broad chemical diversity, and that the presence of secondary compounds mediates plant-animal interactions. As a result very few insects are capable of feeding on the plant parts of members of Apiaceae, and those insects that are capable of feeding on members of this family are often highly specialized (Berenbaum 2001). Currently only two species of Lepidoptera are recorded as having larvae that feed on the plant parts of *E. yuccifolium*: *C. eryngiella* (Molano-Flores 2001 [moths were originally misidentified as *Aristotelia* sp., but were later determined to be *C. eryngiella* by Terry Harrison], pers. obs.) and *Papaipema eryngii* Bird, 1917 (Noctuidae), an Illinois state-threatened species whose larvae bore into the infloreseence stalks (Panzer and Derkovitz 1992). Here I provide some information regarding the life history and behavior of *C. eryngiella* as well as suggestions for

future research.

Description of *Coleotechnites eryngiella*. *C. eryngiella* was originally described by Bottimer (1926) as a species of the genus *Recurvaria*. This species is a small moth (approx. 6 mm in length, 15 mm wingspan) that closely resembles *Coleotechnites variella* (Chambers, 1872) and *Coleotechnites apicitripunctella* (Clemens, 1860). According to Bottimer (1926), *C. eryngiella* differs from *C. variella* in that it has labial palpi and legs marked with black, and it differs from *C. apicitripunctella* in that its face, head and thorax are white and it lacks annulations on its antennae (Fig. 1). The larvae of this species are pink and white-striped (Fig. 1) and have been reported to feed on two species of *Eryngium* (Apiaceae): *Eryngium yuccifolium* (Molano-Flores 2001, pers. obs.) and *Eryngium aquaticum* (Bottimer 1926). The report of *C. eryngiella* on *E. aquaticum* is likely incorrect because the range of *E. aquaticum* does not extend into Texas where Bottimer originally collected the specimen and because the name *E. aquaticum* has been misapplied to plants of *E. yuccifolium* (Mathias and Constance 1941, Gleason and Cronquist 1991).

FIG. 1. The larval, pupal and adult stages of *Coleotechnites eryngiella*.

Observations and Collection Records. During a study examining the effect of herbivory on the reproductive biology of *E. yuccifolium* (Danderson 2005), live larvae and pupae (Fig. 1) were found in inflorescence heads collected from five tallgrass prairie sites: Grant Creek Prairie (Will Co.), Loda Cemetery Prairie (Iroquois Co.), Pellville Cemetery Prairie (Vermilion Co.), Prospect Cemetery Prairie (Ford Co.) and Weston Cemetery Prairie (McLean Co.), in Illinois between late August and early October in both 2003 and 2004. The majority of central and primary lateral inflorescence heads contained between one and seven larvae. The inflorescence heads that were collected were placed within 2 ¼" x 3 ½" manila envelopes which were then placed in plastic sandwich bags and stored at indoor room temperature (20 °C). Within two or three weeks, silky cocoon-like structures containing larvae or pupae could be seen inside the plastic bags. When envelopes were opened in November and December to access the inflorescence heads for dissection, silky cocoon-like structures with empty pupal cases and dead adult moths were often present in the envelope. Storing the inflorescence heads at room temperature likely hastened the transition from larvae to adult.

In *E. yuccifolium*, the larvae feed by boring tunnels into the ovaries and developing mericarps of the flowers (Fig. 2). These tunnels are often lined with silk and full of frass, and shed head capsules from the larvae are common as they change instars. The damage is often extensive, with more than 70% of the flowers showing signs of herbivory (Danderson 2005). Damaged inflorescence heads can be easily differentiated by dark, brown patches of damaged flowers.

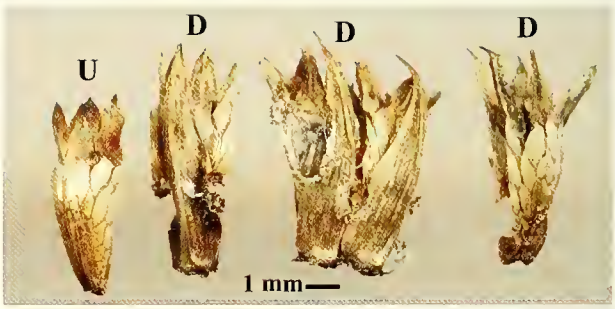

FIG. 2. Undamaged mericarps of *Eryngium yuccifolium* (U) alongside mericarps damaged by the larvae of *Coleotechnites eryngiella* (D).

The populations of *C. eryngiella*, in terms of larvae collected from the inflorescence heads, seemed to vary within sites among years. Grant Creek in 2003 experienced a drastic reduction in the local population of *C. eryngiella* following an accidental prairie burn that burned a large proportion of the prairie. For example, 55% of the mericarps in the central inflorescence heads showed signs of herbivory at Grant Creek in 2000. Following the accidental burn in 2003, 0% of the mericarps in the central inflorescence heads showed signs of herbivory. The Loda site in 2004 experienced a similar, yet not as drastic, population reduction as a result of a prescribed burn on half of the site. In this instance, 37% of the mericarps in the central inflorescence heads showed signs of herbivory in 2003 compared to 10% of the mericarps in the central inflorescence heads in 2004 (Danderson 2005).

During the winter of 2004, I visited the Loda, Pellville and Prospect sites and collected 20 inflorescence stalks at both Loda and Prospect and 10

inflorescence stalks at Pellville. The inflorescence stalks and heads were then dissected and examined for the presence of *C. eryngiella*. Examination of the stalks and inflorescence heads showed no evidence of *C. eryngiella* over-wintering on *E. yuccifolium*; however, among the mericarps and persistent bracts of the inflorescence heads I did find empty pupal cases and dead larvae. Unlike the flowers in the inflorescence heads, there was no evidence that *C. eryngiella* damaged the receptacles of the inflorescence heads or the inflorescence stalks.

During the late spring and summer of 2004, a study examining the effects of herbivory and inflorescence size on pollinator/visitor attraction for *E. yuccifolium* was conducted (Danderson 2005). For this study, the inflorescences of 30 plants that showed no signs of herbivory were covered by fine mesh netting between May 30 and June 22 at Grant Creek, Loda, Pellville, Prospect and Weston. By early July, some of the netted plants showed signs of herbivory. When the inflorescence heads were opened, *C. eryngiella* larvae were present. Similar observations were made by Molano-Flores (2001) when she covered inflorescences with netting in late June for her 1998 study on the reproductive biology of *E. yuccifolium*.

Although no adults were collected by UV light for this study, adults of this species have been collected in prairies and forest in other states by UV light, primarily in the southern US. Collection information for these specimens provides an insight to when adults of this species are present. Most of the specimens held at the Mississippi Entomological Museum (MEM) in Mississippi State, MS were collected by UV light from a few locations in Alabama, Mississippi and Louisiana. The specimens from Alabama were collected from forest habitat in late June and early August. The specimens from Louisiana were collected from forest habitat in late May, early June, early August and mid-September. Specimens from Mississippi were collected in early April, late May, early June, late July and late August in prairie habitat and in late May in forest habitat.

Interpretations of Observations and Collection Records. From the observations and collection records, some aspects of the life history of *C. eryngiella* have become clarified while other aspects remain speculative. It is unclear whether this species is univoltine, bivoltine, or multivoltine in Illinois. Adults have been collected as early as April and as late as September in the southern US and from these collection records this species appears to be bivoltine or possibly multivoltine in the South. However, numerous collections within sites at regular intervals from spring to fall are needed for confirmation. Also, voltinism patterns may vary across its range.

Eggs may be laid in the developing inflorescences of *E. yuccifolium* early in the spring, possibly between April and May (Molano-Flores 2001, Danderson 2005), as suggested by the lack of empty egg cases on the foliage or on the inflorescence stalks in late spring. If this species is bivoltine or multivoltine, eggs may be laid in the inflorescence heads later in the summer as well.

Evidence suggests that this species likely diapauses as pupae; larvae are readily collected in late summer and early fall, eggs are laid in spring, and larvae and eggs are absent in the persistent inflorescence stalks and receptacles. There was no evidence to suggest that *C. eryngiella* over-winters in the persistent inflorescence stalks; however, this species might over-winter in the dispersed mericarps. In autumn, the mericarps tend to fall off the receptacle of the inflorescence, and, in view of the fact that pupae and silky cocoon-like structures have been observed in the tunneled-out mericarps from inflorescences collected during fall, diapause inside the mericarps seems likely. Diapause in mericarps amongst the leaf litter at the base of the plants may explain why populations of this moth tend to experience a decline in the season following a prescribed burn (i.e., Grant Creek in 2003 and Loda in 2004, pers. obs.).

C. eryngiella may have a large range. Collections of larvae and adults of this species have been made in Alabama, Illinois, Louisiana, Mississippi and Texas (Bottimer 1926, Mississippi Entomological Museum 2005, pers. obs.). However, like many microlepidoptera species, this species has been under-collected and as a result, the full extent of its range is poorly understood. Potentially, the range of this species could correspond with the range of *E. yuccifolium*, which extends from Connecticut west to Minnesota and south from Florida to Texas (Mathias and Constance 1941, USDA 2004). Also, it is not known whether this moth feeds on the other 18 species of *Eryngium* east of the Rocky Mountains or other unrelated taxa, but if it does then the range of *C. eryngiella* could be even larger.

Many aspects of the life history of this moth and its relationship with *E. yuccifolium* and prairie habitat have yet to be studied. Much is speculative and needs further clarification. Previous studies (Molano-Flores 2001, Danderson 2005) have only examined the effect of *C. eryngiella* on the reproductive biology of *E. yuccifolium* and have demonstrated that the presence of this moth can greatly reduce the number of seeds produced, directly by damaging the seeds or indirectly by causing floral damage that limits an individual plant's ability to attract pollinators. For example, at Grant Creek in 2003 when 0% of the mericarps in the central inflorescence heads showed signs of herbivory due to

the accidental burn, the central inflorescence heads had a mean seed set of 62%. By comparison, 72% of the mericarps in the central inflorescence heads showed signs of herbivory and the central inflorescence heads had a mean seed set of 13% at Grant Creek in 2004 (Danderson 2005). Currently, only one long-term study is examining the effect that *C. eryngiella* may have on populations of *E. yuccifolium* in remnant and restoration prairies (Molano-Flores pers. com.). The effects of prescribed burns on *C. eryngiella* are relatively unknown, although preliminary evidence suggests that their populations can be drastically reduced following a prescribed burn. Studies examining the long-term effects of prescribed burns on the relationship between *C. eryngiella* and *E. yuccifolium* are also suggested.

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